REMARKS

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE".

Applicant has amended the specification and abstract to comport with United States Patent and Trademark Office Rules. No new matter is added. Applicant has amended the claims to eliminate multiple dependency and to comport with U.S. practice, which is totally unrelated to patentability. No new matter is added.

In view of the above, it is respectfully believed that all the presently submitted claims are allowable and a Formal Notice of Allowance is courteously solicited. It is believed that the application is in condition for allowance, however, if the Examiner feels otherwise, a telephone interview is respectfully requested. An early notice of allowance is solicited.

Respectfully submitted,

Date: November 29 2001

Kevin M. Kercher, Reg. No. 33,408
Blackwell Sanders Peper Martin LLP
720 Olive Street, 24th Floor
St. Louis, MO 63101
Telephone: (314) 345-6000
Fax: (314) 345-6060

VERSION WITH MARKINGS TO SHOW CHANGES MADE

Following is a marked-up version of the Specification with all changes shown by conventional comparison (underlining and bracketing):

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SPORTS VEHICLE

TECHNICAL FIELD

This invention relates to a sports vehicle that enables a person to travel downhill over terrain whose surface characteristics would render the use of a skateboard or snowboard impracticable, and in particular to a sports vehicle which may be ridden by a person standing on a platform on the vehicle.

BACKGROUND OF THE INVENTION

Devices such as the skateboard and snowboard are well known. The skateboard enables its user to travel over surfaces such as tarmac and concrete, which are relatively smooth and firm. The snowboard enables its user to travel over snow-covered surfaces, which offer a low coefficient of friction. Neither of these devices is suitable for travelling over grassland or any other terrain that lacks the smoothness and firmness required by the skateboard and the low coefficient of friction required by the snowboard.

SUMMARY OF THE INVENTION

The object of this invention is to provide a device that enables its user to indulge in pursuits similar to skateboarding and snowboarding over terrain such as grassland.

According to a first aspect of the present invention, there is provided a vehicle for travelling over grassland and similar terrain, said vehicle comprising a generally horizontal platform having attached to its underside one or more rotatable disks each having a lower surface adapted to contact the ground, each of said one or more rotatable disks arranged to rotate about a generally vertical axis, the underside of each of said one or more rotatable disks being substantially convex in form.

Preferably, said vehicle has two or more rotatable disks arranged along a longitudinal axis of said platform.

Preferably, said platform is resiliently pliable. Preferably, said platform comprises a first area on its upper side towards the front of said platform adapted to receive one foot of the user, and a second area on its upper side towards the rear of said platform adapted to receive the other foot of the user, said platform comprising a central portion between said first and second areas adapted to flex resiliently about a lateral axis in the plane of said platform. Preferably, said first and second areas are provided with boot or shoe retention means. The platform may further comprise a hinge mechanism extending laterally across said platform to aid pliability. The first area of the platform may be provided with a first rotatably mounted foot support member, while the second area of the platform may be provided with a second rotatably mounted foot support member. Preferably each foot support member is rotatably mounted such that its axis of rotation is substantially coincident with the axis of rotation of a rotatable disk. Preferably said first and second foot support members are each provided with boot or shoe retention means.

Preferably, said central portion comprises a portion of said platform having a reduced cross-sectional area. Preferably, said central portion comprises a waist portion of the platform having a reduced width.

In one embodiment the platform may have a generally concave shape in a longitudinal direction in its unstressed state, such that the central portion of the platform is lower than the ends of the platform. In another embodiment the platform may have a generally convex shape in a longitudinal direction in its unstressed state, such that the central portion of the platform is higher than the ends of the platform.

Preferably, each of said one or more rotatable disks is supported on a spindle attached to

the underside of said platform. Preferably, said vehicle further comprises additional support means adapted to provide additional support for each of said one or more rotatable disks in addition to said spindle. Preferably, said additional support means is either a plurality of idler wheels or rollers. Alternatively, each of said one or more rotatable disks is supported solely by either a plurality of idler wheels, a plurality of rollers, or a plurality of balls.

Preferably, each of said one or more rotatable disks is solid.

Alternatively, each of said one or more rotatable disks is hollow, said upper surface of each of said one or more rotatable disks being substantially concave in form. Preferably, said platform is shaped so as to follow the form of said concave upper surface of each of said one or more hollow rotatable disks.

Preferably, the lower surface of each of said one or more rotatable disks is substantially in the form of part of the surface of a sphere. Alternatively, the lower surface of each of said one or more rotatable disks may be substantially in the form of part of the surface of an ellipsoid, a truncated cone, or a truncated toroid.

Preferably, said vehicle further comprises means for the attachment of a sail, to permit the user to traverse substantially level terrain.

Preferably, the platform and rotatable disks are made of composite plastics materials, and the other parts that support the rotatable disks are made of metal, but the platform may instead be made of natural materials, such as wood, and the rotatable disks may be made of metal.

According to a second aspect of the present invention there is provided a vehicle for travelling over grassland and similar terrain, said vehicle comprising a substantially horizontal platform having attached to its underside three or more rotatable disks arranged longitudinally, at least one of said rotatable disks having a first inclined axis, and at least one rotatable disk having

a second inclined axis inclined in the opposite sense to said first inclined axis.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the invention will now be described with reference to the accompanying drawings in which:

Figs. 1a and 1b show a side elevation and plan view respectively of a vehicle according to the invention, with the mounting spindle shown schematically;

Figs. 2a and 2b show an end elevation and plan view respectively of the vehicle of Fig. 1 with the platform parallel to the ground;

Figs. 3a and 3b show an end elevation and plan view respectively of the vehicle of Fig. 1 with the platform tilted to one side;

Figs. 4a and 4b show a side elevation and plan view respectively of the vehicle of Fig. 1 when positioned on a sloping surface;

Figs. 5a and 5b show a side elevation and plan view respectively of another vehicle according to the invention having two rotatable disks with the platform flat, the mounting spindles being shown schematically;

Figs. 6a and 6b show a side elevation and plan view respectively of the vehicle of Fig. 5 with the platform curved upwards towards its ends;

Figs. 7a and 7b show a side elevation and plan view respectively of the vehicle of Fig. 5 with the platform curved downwards towards its ends;

Fig. 8a shows a longitudinal section through a vehicle according to the invention showing the rotatable disk mounting arrangement with a central spindle;

Fig. 8b is an enlarged view of part of the longitudinal section of Fig. 8a;

Fig. 9 shows a transverse section through a solid rotatable disk of the vehicle of Fig. 8a;

Fig. 10 shows a transverse section through a hollow rotatable disk;

Fig. 11 shows a transverse section through a rotatable disk mounting arrangement with no central spindle of another vehicle according to the invention;

Fig. 12 shows a transverse section through another platform according to the invention in which the platform follows the form of the rotatable disks;

Figs. 13a and 13b show a side elevation and an end elevation respectively of a vehicle according to a further embodiment of the invention;

Fig. 14 shows a plan view of a vehicle according to a further embodiment of the invention having rotatable foot supports; and

Fig. 15 shows a plan view of the vehicle of Fig. 15 with the foot supports in a rotated position.

DETAILED DESCRIPTION OF THE INVENTION

In the embodiments illustrated in Figs. 1 to 4, the vehicle according to the invention comprises a platform 1 capable of supporting the user and having on its underside one or more rotatable disks 2. Each rotatable disk 2 rotates about a spindle 3, which is attached at one end to the underside of the platform with its axis perpendicular to the underside of the platform. The user stands on the platform, with his feet in approximately the position 4 shown in Fig. 1, and he may adopt a crouching stance to enable him to grip handgrips 5 located at each end of the platform.

When the platform 1 is parallel to the ground, as shown in Fig. 2, the point of contact 20 with the ground 30 of each rotatable disk 2 (as seen in plan view) is coincident with the [centre] center of the rotatable disk 2, and any force applied in the plane of the platform 1 will not result in a turning moment being applied to the rotatable disks 2. However, when the platform 1 is

tilted to one side, as shown in Fig. 3, the point of contact 22 of each disk 2 with the ground 30 is not coincident with the [centre] center 24 of the rotatable disk 2, and a force applied to the platform 1 will normally cause a turning moment to be applied to the rotatable disks 2.

As shown in Fig. 4, when the platform 1 is resting on a sloping surface 32 of sufficient gradient, and is tilted in a direction other than the direction of maximum gradient, the turning moment induced in the rotatable disks 2 is sufficient to overcome the friction that exists at the point of contact 22 with the ground 32, and the device travels in a downhill direction.

Fig. 5 shows an embodiment of the vehicle of the invention having two rotatable disks 2 and a pliable platform 1 with handgrips 5 at each end. When the platform 1 is flat, the imaginary lines 40 joining the [centre] center 24 of each rotatable disk 2 to its point of contact 22 with the ground (as seen in plan view) are perpendicular to the longitudinal axis of the platform, and the vehicle travels in the direction of the longitudinal axis, indicated by the arrow 42. However, if the ends 44 of the platform are pulled upwards by the user pulling on the handgrips 5, causing the platform 1 to assume a curvature of the type shown in Fig. 6, that is a concave curvature of the upper face of the platform 1, the imaginary lines 46 joining the [centre] center 24 of each rotatable disk 2 to its point of contact 22a with the ground are no longer perpendicular to the longitudinal axis and the vehicle steers towards the side 45 to which it has been tilted, in the direction of the arrow 48. Conversely, if the ends 44 of the platform 1 are pushed downwards by the user, causing the platform to assume a curvature of the type shown in Fig. 7, that is a convex curvature of the upper face of the platform 1, the device steers towards the opposite side, in the direction of arrow 52. The imaginary lines 50 joining the [centre] center 24 of each rotatable disk 2 to its point of contact 22b with the ground are not perpendicular to the longitudinal axis and the vehicle steers away from the side to which it has been tilted.

Figs. 8a and 8b show a detailed embodiment of a vehicle according to the invention. In this embodiment, handgrips 5a are provided in the form of a longitudinal extension of the platform 1 at each end of the platform beyond the outer edge of the adjacent rotatable disk 2. A metal spindle 3 is attached by bolts 60 or other means to the underside of the platform 1. Rolling element bearings 6 are fitted between the spindle 3 and the rotatable disk 2 to reduce the friction and wear arising from rotation of the rotatable disk on the spindle, and the assembly is made secure by a nut 7 secured to the threaded end 62 of the spindle 3, so that the two bearings 6 are held between the nut 7 and a shoulder 64 provided at the upper end of the spindle 3.

The underside of each of the rotatable disks 2 may take a variety of forms, including a segment of a sphere, a segment of an ellipsoid, a truncated cone, a truncated toroid or a combination of these forms. The choice of form is dictated by the contact area required to prevent the rotatable disk sinking into the ground; the nature of the undulations inherent in the terrain over which the device is to be used; and the requirement that the device should not be unduly difficult to balance.

The rotatable disks 2 may be of solid construction, as shown in Fig. 9, or hollow construction, as shown in Fig. 10. The material may be a [mouldable] moldable plastic or resin, metal, alloy, composite or any material which can be formed and has the requisite strength and stiffness. Hollow rotatable disks have an outer shell 70 and may have internal ribs 76 (shown in Fig. 13a) to increase their stiffness. Where hollow construction is used, as shown in Fig. 10, one or more idler wheels 8 may be employed to provide additional support to the rotatable disks 2, as shown in Fig 10. Each idler wheel is rotatably mounted on a bracket (not shown) which is fixed to the underside of the platform 1. The wheel 8 is oriented so that its axis or rotation 72 is parallel to the contact surface 74 on the disk 2. The provision of idler wheels 8 serves to reduce

the bending moment which must be withstood by the spindle 3 and its bolted connection to the platform 1. It is to be understood that roller or balls may be used to support the edges of the disks 2 in the same way as the idler wheels 8 described above.

Fig. 11 shows an alternative form of rotational support by means of which a disk 2 may be rotatably mounted on the platform 1. A plurality of balls 9 are mounted circumferentially in a ball support channel formed by an outer flange 80 attached to the disk 2 and an inner flange 82 mounted securely to the underside of the platform 1. It is to be understood that other forms of roller or ball bearing which extend around the circumference of the rotatable disk 2 may be used.

Where hollow rotatable disks 2 are used, the platform 1 may be formed in such a way that it follows the form of the upper surface 90 of the rotatable disks 2, as shown in Fig. 12. The user's feet are placed in the concave section of the platform 1. This configuration enables the user to remain closer to the ground and to stand on a surface that is approximately parallel to the ground, since if the user applies weight at a point 92 to one side of the longitudinal axis of the platform 1, then the vehicle 1 will tilt about the longitudinal axis so that the point 94 on the disk 2 comes into contact with the ground 30 and the adjacent part of the platform at point 92 is substantially parallel to the ground 30. In addition, this concave section could be adapted to provide a flat, horizontal surface for the user's feet when the platform is tilted to the appropriate angle, if the upper surface is profiled to the shape shown by the dotted line 96.

A further embodiment of the invention is shown in Fig. 13 which has three rotatable disks 2 mounted on the underside of the platform 1. The two rotatable disks 2a at the ends of the platform 1 are tilted by a particular tilt angle about the longitudinal axis of the platform 1 in one direction, whilst the central rotatable disk 2b is angled by the same or similar tilt angle in the opposite direction. With this arrangement, the platform 1 remains horizontal, but the vehicle can

still be steered by deflection of the platform 1 as with the other embodiments.

Figs. 14 and 15 illustrate an embodiment in which the top of the platform 1 is provided with rotatable foot support members 100 which are connected by a rotatable hinge 102 to a point on the upper surface of the platform 1 corresponding to the [centre] center of rotation of the disk 2. The foot support members 100 in the illustrated embodiment are in the form of rigid plates, which may have rollers, bearings or low-friction coatings (not shown) on their underside so that they can rotate freely with respect to the platform 1. The same spindle 3 used to mount the rotatable disk 2 can also be used to mount the hinge 102. In this way the foot support members 100 can rotate about axes coincident with the axes of the rotatable disks 2. The user places his feet on the foot support members 100 and applies his weight through his heels in the normal manner to tilt the platform to one side. If he then moves his heels closer together and thereby rotates the foot support members 100 to the position 100a in Fig. 15, then the platform will assume a "concave up" position, as shown in Fig. 6, causing the vehicle to steer to one side. If he moves his heels further apart and thereby rotates the foot support members 100 to the position 100b in Fig. 15, then the platform will assume a "concave down" position, as shown in Fig. 7, causing the vehicle to steer to the other side. The foot support members may be of any suitable shape and may be fitted with boot or shoe retention devices, such as a simple toe strap 104 or any device of the sort known in the art of snowboarding, skiing and roller skating.

The device could also be provided with means to which a sail and mast may be attached, if the user was to traverse substantially level terrain. The attachment of such a sail would therefore enable the user to cross terrain with the minimum of effort being required.

Pliability of the platform 1 may be achieved by constructing it entirely of flexible materials, or by using a combination of rigid materials in the vicinity of the user's feet and

flexible materials for the middle portion. A region of reduced cross-sectional area may also be incorporated in the platform to facilitate deflection, or a mechanical hinge (not shown) may be employed, which extends across the width of the platform. The hinge may have some form of damping arrangement, to prevent the platform from being too flexible.

The illustrated embodiments show the platform 1 to have a generally flat shape in the unstressed state. However it is to be understood that the platform may, in its unstressed condition, have a concave or convex upper surface, of the form illustrated in Figs 6a or 7a respectively. Having such a shape will give the vehicle a natural tendency to steer to one side or the other in the absence of a specific deflection of the platform by the user. In such circumstances a user can adopt a zigzag course by standing on one side of the platform 1 while proceeding on a first leg of the zigzag course, then at the turning point rotating the board through 180° about a vertical axis and standing on what is effectively the other side of the platform 1 while proceeding on the second leg of the zigzag course.

These and other modifications and variations are possible without departing from the scope of the invention.

1. CLAIMS

1. A vehicle for travelling over grassland and similar terrain, said vehicle comprising a generally horizontal platform having attached to its underside two or more rotatable disks each having a lower surface adapted to contact the ground, each of said two or more rotatable disks arranged to rotate about a generally vertical axis, the underside of each of said [one] two or more rotatable disks being substantially convex in form.

2. [A] The vehicle according to Claim 1, wherein said two or more rotatable disks are arranged along a longitudinal axis of said platform.

3. [A] The vehicle according to Claim 1, wherein said vehicle has two rotatable disks arranged along a longitudinal axis of said platform.

4. [A] The vehicle according to [any preceding] Claim 1, wherein said platform is resiliently pliable.

5. [A] The vehicle according to [any preceding] Claim 1, wherein said platform comprises a first area on its upper side towards the front of said platform adapted to receive one foot of the user, and a second area on its upper side towards the rear of said platform adapted to receive the other foot of the user, said platform comprising a central portion between said first and second areas adapted to flex resiliently about a lateral axis in the plane of said platform.

6. [A] The vehicle according to Claim 5, wherein the first area of the platform is provided with a first rotatably mounted foot support member, and the second area of the platform is provided with a second rotatably mounted foot support member.

7. [A] The vehicle according to Claim 6, wherein each foot support member is rotatably mounted such that its axis of rotation is substantially coincident with the axis of rotation of a rotatable disk.

8. [A] The vehicle according to Claim 6 [or 7], wherein said first and second foot support members are each provided with boot or shoe retention means.

9. [A] The vehicle according to [any preceding] Claim 1, wherein said central portion comprises a portion of said platform having a reduced cross-sectional area.

10. [A] The vehicle according to [any preceding] Claim 1, wherein the platform has a generally concave shape in a longitudinal direction in its unstressed state, such that the central portion of the platform is lower than the ends of the platform.

11. [A] The vehicle according to [any one of Claims 1 to 9] Claim 1, wherein the platform has a generally convex shape in a longitudinal direction in its unstressed state, such that the central portion of the platform is higher than the ends of the platform.

12. [A] The vehicle according to [any preceding] Claim 1, wherein each of said [one] two or more rotatable disks is supported on a spindle attached to the underside of said platform.

13. [A] The vehicle according to Claim 12, wherein said vehicle further comprises additional support means adapted to provide additional support for each of said [one] two or more rotatable disks in addition to said spindle.

14. [A] The vehicle [as claimed in] according to Claim 13, wherein said additional support means is a plurality of idler wheels.

15. [A] The vehicle [as claimed in] according to Claim 13, wherein said additional support means is a plurality of rollers.

16. [A] The vehicle [as claimed in any of Claims 1 to 12] according to Claim 1, wherein each of said [one] two or more rotatable disks is supported by a support means selected from the group of support means comprising a plurality of idler wheels, a plurality of rollers, and a plurality of balls.

17. [A] The vehicle according to [any preceding] Claim 1, wherein each of said [one] two or more rotatable disks is solid.

18. [A] The vehicle according to [any one of Claims 1 to 16] Claim 1, wherein each of said [one] two or more rotatable disks is hollow, said upper surface of each of said [one] two or more rotatable disks being substantially concave in form.

19. [A] The vehicle according to Claim 18, wherein said platform is shaped so as to follow the form of said concave upper surface of each of said [one] two or more hollow rotatable disks.

20. [A] The vehicle according to [any preceding] Claim 1, wherein the lower surface of each of said [one] two or more rotatable disks is substantially in the form of part of the surface of a sphere, an ellipsoid, a truncated cone, or a truncated toroid.

21. [A] The vehicle according to Claim 2, the axis of rotation of at least one of said rotatable disks being inclined in a first rotational sense about the longitudinal axis of the platform, and the axis of rotation of at least one other rotatable disk being inclined in an opposite rotational sense about the longitudinal axis of the platform.

22. [A] The vehicle according to Claim 21, wherein the platform has attached to its underside three or more rotatable disks arranged along the longitudinal axis of said platform.

ABSTRACT

A sports vehicle which includes a substantially horizontal platform [(1)] capable of supporting the user and having attached to its underside two or more rotatable disks [(2)] arranged to rotate about substantially vertical axes [(3)], the underside of each rotatable disk being substantially convex in form. The platform is resilient and can adopt a convex or concave shape, so as to steer the vehicle. The user places his feet on the platform and steers the vehicle by tilting the platform using his body weight. The vehicle enables its user to travel over grassland and similar terrain in a manner similar to skateboarding and snowboarding.

VERSION WITH MARKINGS TO SHOW CHANGES MADE

Following is a marked-up version of the Specification with all changes shown by conventional comparison (underlining and bracketing):

SPORTS VEHICLE

TECHNICAL FIELD

This invention relates to a sports vehicle that enables a person to travel downhill over terrain whose surface characteristics would render the use of a skateboard or snowboard impracticable, and in particular to a sports vehicle which may be ridden by a person standing on a platform on the vehicle.

BACKGROUND OF THE INVENTION

Devices such as the skateboard and snowboard are well known. The skateboard enables its user to travel over surfaces such as tarmac and concrete, which are relatively smooth and firm. The snowboard enables its user to travel over snow-covered surfaces, which offer a low coefficient of friction. Neither of these devices is suitable for travelling over grassland or any other terrain that lacks the smoothness and firmness required by the skateboard and the low coefficient of friction required by the snowboard.

SUMMARY OF THE INVENTION

The object of this invention is to provide a device that enables its user to indulge in pursuits similar to skateboarding and snowboarding over terrain such as grassland.

According to a first aspect of the present invention, there is provided a vehicle for travelling over grassland and similar terrain, said vehicle comprising a generally horizontal platform having attached to its underside one or more rotatable disks each having a lower surface adapted to contact the ground, each of said one or more rotatable disks arranged to rotate about a generally vertical axis, the underside of each of said one or more rotatable disks being substantially convex in form.

Preferably, said vehicle has two or more rotatable disks arranged along a longitudinal axis of said platform.

Preferably, said platform is resiliently pliable. Preferably, said platform comprises a first area on its upper side towards the front of said platform adapted to receive one foot of the user, and a second area on its upper side towards the rear of said platform adapted to receive the other foot of the user, said platform comprising a central portion between said first and second areas adapted to flex resiliently about a lateral axis in the plane of said platform. Preferably, said first and second areas are provided with boot or shoe retention means. The platform may further comprise a hinge mechanism extending laterally across said platform to aid pliability. The first area of the platform may be provided with a first rotatably mounted foot support member, while the second area of the platform may be provided with a second rotatably mounted foot support member. Preferably each foot support member is rotatably mounted such that its axis of rotation is substantially coincident with the axis of rotation of a rotatable disk. Preferably said first and second foot support members are each provided with boot or shoe retention means.

Preferably, said central portion comprises a portion of said platform having a reduced cross-sectional area. Preferably, said central portion comprises a waist portion of the platform having a reduced width.

In one embodiment the platform may have a generally concave shape in a longitudinal direction in its unstressed state, such that the central portion of the platform is lower than the ends of the platform. In another embodiment the platform may have a generally convex shape in a longitudinal direction in its unstressed state, such that the central portion of the platform is higher than the ends of the platform.

Preferably, each of said one or more rotatable disks is supported on a spindle attached to

the underside of said platform. Preferably, said vehicle further comprises additional support means adapted to provide additional support for each of said one or more rotatable disks in addition to said spindle. Preferably, said additional support means is either a plurality of idler wheels or rollers. Alternatively, each of said one or more rotatable disks is supported solely by either a plurality of idler wheels, a plurality of rollers, or a plurality of balls.

Preferably, each of said one or more rotatable disks is solid.

Alternatively, each of said one or more rotatable disks is hollow, said upper surface of each of said one or more rotatable disks being substantially concave in form. Preferably, said platform is shaped so as to follow the form of said concave upper surface of each of said one or more hollow rotatable disks.

Preferably, the lower surface of each of said one or more rotatable disks is substantially in the form of part of the surface of a sphere. Alternatively, the lower surface of each of said one or more rotatable disks may be substantially in the form of part of the surface of an ellipsoid, a truncated cone, or a truncated toroid.

Preferably, said vehicle further comprises means for the attachment of a sail, to permit the user to traverse substantially level terrain.

Preferably, the platform and rotatable disks are made of composite plastics materials, and the other parts that support the rotatable disks are made of metal, but the platform may instead be made of natural materials, such as wood, and the rotatable disks may be made of metal.

According to a second aspect of the present invention there is provided a vehicle for travelling over grassland and similar terrain, said vehicle comprising a substantially horizontal platform having attached to its underside three or more rotatable disks arranged longitudinally, at least one of said rotatable disks having a first inclined axis, and at least one rotatable disk having

a second inclined axis inclined in the opposite sense to said first inclined axis.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the invention will now be described with reference to the accompanying drawings in which:

Figs. 1a and 1b show a side elevation and plan view respectively of a vehicle according to the invention, with the mounting spindle shown schematically;

Figs. 2a and 2b show an end elevation and plan view respectively of the vehicle of Fig. 1 with the platform parallel to the ground;

Figs. 3a and 3b show an end elevation and plan view respectively of the vehicle of Fig. 1 with the platform tilted to one side;

Figs. 4a and 4b show a side elevation and plan view respectively of the vehicle of Fig. 1 when positioned on a sloping surface;

Figs. 5a and 5b show a side elevation and plan view respectively of another vehicle according to the invention having two rotatable disks with the platform flat, the mounting spindles being shown schematically;

Figs. 6a and 6b show a side elevation and plan view respectively of the vehicle of Fig. 5 with the platform curved upwards towards its ends;

Figs. 7a and 7b show a side elevation and plan view respectively of the vehicle of Fig. 5 with the platform curved downwards towards its ends;

Fig. 8a shows a longitudinal section through a vehicle according to the invention showing the rotatable disk mounting arrangement with a central spindle;

Fig. 8b is an enlarged view of part of the longitudinal section of Fig. 8a;

Fig. 9 shows a transverse section through a solid rotatable disk of the vehicle of Fig. 8a;

Fig. 10 shows a transverse section through a hollow rotatable disk;

Fig. 11 shows a transverse section through a rotatable disk mounting arrangement with no central spindle of another vehicle according to the invention;

Fig. 12 shows a transverse section through another platform according to the invention in which the platform follows the form of the rotatable disks;

Figs. 13a and 13b show a side elevation and an end elevation respectively of a vehicle according to a further embodiment of the invention;

Fig. 14 shows a plan view of a vehicle according to a further embodiment of the invention having rotatable foot supports; and

Fig. 15 shows a plan view of the vehicle of Fig. 15 with the foot supports in a rotated position.

DETAILED DESCRIPTION OF THE INVENTION

In the embodiments illustrated in Figs. 1 to 4, the vehicle according to the invention comprises a platform 1 capable of supporting the user and having on its underside one or more rotatable disks 2. Each rotatable disk 2 rotates about a spindle 3, which is attached at one end to the underside of the platform with its axis perpendicular to the underside of the platform. The user stands on the platform, with his feet in approximately the position 4 shown in Fig. 1, and he may adopt a crouching stance to enable him to grip handgrips 5 located at each end of the platform.

When the platform 1 is parallel to the ground, as shown in Fig. 2, the point of contact 20 with the ground 30 of each rotatable disk 2 (as seen in plan view) is coincident with the [centre] center of the rotatable disk 2, and any force applied in the plane of the platform 1 will not result in a turning moment being applied to the rotatable disks 2. However, when the platform 1 is

tilted to one side, as shown in Fig. 3, the point of contact 22 of each disk 2 with the ground 30 is not coincident with the [centre] center 24 of the rotatable disk 2, and a force applied to the platform 1 will normally cause a turning moment to be applied to the rotatable disks 2.

As shown in Fig. 4, when the platform 1 is resting on a sloping surface 32 of sufficient gradient, and is tilted in a direction other than the direction of maximum gradient, the turning moment induced in the rotatable disks 2 is sufficient to overcome the friction that exists at the point of contact 22 with the ground 32, and the device travels in a downhill direction.

Fig. 5 shows an embodiment of the vehicle of the invention having two rotatable disks 2 and a pliable platform 1 with handgrips 5 at each end. When the platform 1 is flat, the imaginary lines 40 joining the [centre] center 24 of each rotatable disk 2 to its point of contact 22 with the ground (as seen in plan view) are perpendicular to the longitudinal axis of the platform, and the vehicle travels in the direction of the longitudinal axis, indicated by the arrow 42. However, if the ends 44 of the platform are pulled upwards by the user pulling on the handgrips 5, causing the platform 1 to assume a curvature of the type shown in Fig. 6, that is a concave curvature of the upper face of the platform 1, the imaginary lines 46 joining the [centre] center 24 of each rotatable disk 2 to its point of contact 22a with the ground are no longer perpendicular to the longitudinal axis and the vehicle steers towards the side 45 to which it has been tilted, in the direction of the arrow 48. Conversely, if the ends 44 of the platform 1 are pushed downwards by the user, causing the platform to assume a curvature of the type shown in Fig. 7, that is a convex curvature of the upper face of the platform 1, the device steers towards the opposite side, in the direction of arrow 52. The imaginary lines 50 joining the [centre] center 24 of each rotatable disk 2 to its point of contact 22b with the ground are not perpendicular to the longitudinal axis and the vehicle steers away from the side to which it has been tilted.

Figs. 8a and 8b show a detailed embodiment of a vehicle according to the invention. In this embodiment, handgrips 5a are provided in the form of a longitudinal extension of the platform 1 at each end of the platform beyond the outer edge of the adjacent rotatable disk 2. A metal spindle 3 is attached by bolts 60 or other means to the underside of the platform 1. Rolling element bearings 6 are fitted between the spindle 3 and the rotatable disk 2 to reduce the friction and wear arising from rotation of the rotatable disk on the spindle, and the assembly is made secure by a nut 7 secured to the threaded end 62 of the spindle 3, so that the two bearings 6 are held between the nut 7 and a shoulder 64 provided at the upper end of the spindle 3.

The underside of each of the rotatable disks 2 may take a variety of forms, including a segment of a sphere, a segment of an ellipsoid, a truncated cone, a truncated toroid or a combination of these forms. The choice of form is dictated by the contact area required to prevent the rotatable disk sinking into the ground; the nature of the undulations inherent in the terrain over which the device is to be used; and the requirement that the device should not be unduly difficult to balance.

The rotatable disks 2 may be of solid construction, as shown in Fig. 9, or hollow construction, as shown in Fig. 10. The material may be a [mouldable] moldable plastic or resin, metal, alloy, composite or any material which can be formed and has the requisite strength and stiffness. Hollow rotatable disks have an outer shell 70 and may have internal ribs 76 (shown in Fig. 13a) to increase their stiffness. Where hollow construction is used, as shown in Fig. 10, one or more idler wheels 8 may be employed to provide additional support to the rotatable disks 2, as shown in Fig 10. Each idler wheel is rotatably mounted on a bracket (not shown) which is fixed to the underside of the platform 1. The wheel 8 is oriented so that its axis or rotation 72 is parallel to the contact surface 74 on the disk 2. The provision of idler wheels 8 serves to reduce

the bending moment which must be withstood by the spindle 3 and its bolted connection to the platform 1. It is to be understood that roller or balls may be used to support the edges of the disks 2 in the same way as the idler wheels 8 described above.

Fig. 11 shows an alternative form of rotational support by means of which a disk 2 may be rotatably mounted on the platform 1. A plurality of balls 9 are mounted circumferentially in a ball support channel formed by an outer flange 80 attached to the disk 2 and an inner flange 82 mounted securely to the underside of the platform 1. It is to be understood that other forms of roller or ball bearing which extend around the circumference of the rotatable disk 2 may be used.

Where hollow rotatable disks 2 are used, the platform 1 may be formed in such a way that it follows the form of the upper surface 90 of the rotatable disks 2, as shown in Fig. 12. The user's feet are placed in the concave section of the platform 1. This configuration enables the user to remain closer to the ground and to stand on a surface that is approximately parallel to the ground, since if the user applies weight at a point 92 to one side of the longitudinal axis of the platform 1, then the vehicle 1 will tilt about the longitudinal axis so that the point 94 on the disk 2 comes into contact with the ground 30 and the adjacent part of the platform at point 92 is substantially parallel to the ground 30. In addition, this concave section could be adapted to provide a flat, horizontal surface for the user's feet when the platform is tilted to the appropriate angle, if the upper surface is profiled to the shape shown by the dotted line 96.

A further embodiment of the invention is shown in Fig. 13 which has three rotatable disks 2 mounted on the underside of the platform 1. The two rotatable disks 2a at the ends of the platform 1 are tilted by a particular tilt angle about the longitudinal axis of the platform 1 in one direction, whilst the central rotatable disk 2b is angled by the same or similar tilt angle in the opposite direction. With this arrangement, the platform 1 remains horizontal, but the vehicle can

still be steered by deflection of the platform 1 as with the other embodiments.

Figs. 14 and 15 illustrate an embodiment in which the top of the platform 1 is provided with rotatable foot support members 100 which are connected by a rotatable hinge 102 to a point on the upper surface of the platform 1 corresponding to the [centre] center of rotation of the disk 2. The foot support members 100 in the illustrated embodiment are in the form of rigid plates, which may have rollers, bearings or low-friction coatings (not shown) on their underside so that they can rotate freely with respect to the platform 1. The same spindle 3 used to mount the rotatable disk 2 can also be used to mount the hinge 102. In this way the foot support members 100 can rotate about axes coincident with the axes of the rotatable disks 2. The user places his feet on the foot support members 100 and applies his weight through his heels in the normal manner to tilt the platform to one side. If he then moves his heels closer together and thereby rotates the foot support members 100 to the position 100a in Fig. 15, then the platform will assume a "concave up" position, as shown in Fig. 6, causing the vehicle to steer to one side. If he moves his heels further apart and thereby rotates the foot support members 100 to the position 100b in Fig. 15, then the platform will assume a "concave down" position, as shown in Fig. 7, causing the vehicle to steer to the other side. The foot support members may be of any suitable shape and may be fitted with boot or shoe retention devices, such as a simple toe strap 104 or any device of the sort known in the art of snowboarding, skiing and roller skating.

The device could also be provided with means to which a sail and mast may be attached, if the user was to traverse substantially level terrain. The attachment of such a sail would therefore enable the user to cross terrain with the minimum of effort being required.

Pliability of the platform 1 may be achieved by constructing it entirely of flexible materials, or by using a combination of rigid materials in the vicinity of the user's feet and

flexible materials for the middle portion. A region of reduced cross-sectional area may also be incorporated in the platform to facilitate deflection, or a mechanical hinge (not shown) may be employed, which extends across the width of the platform. The hinge may have some form of damping arrangement, to prevent the platform from being too flexible.

The illustrated embodiments show the platform 1 to have a generally flat shape in the unstressed state. However it is to be understood that the platform may, in its unstressed condition, have a concave or convex upper surface, of the form illustrated in Figs 6a or 7a respectively. Having such a shape will give the vehicle a natural tendency to steer to one side or the other in the absence of a specific deflection of the platform by the user. In such circumstances a user can adopt a zigzag course by standing on one side of the platform 1 while proceeding on a first leg of the zigzag course, then at the turning point rotating the board through 180° about a vertical axis and standing on what is effectively the other side of the platform 1 while proceeding on the second leg of the zigzag course.

These and other modifications and variations are possible without departing from the scope of the invention.